August 26, 2011

Demonstration of Substantial and Widespread Economic Impacts to Montana That Would Result if Base Numeric Nutrient Standards had to be Met Today-- DRAFT

Executive Summary

An analysis was undertaken to determine the degree and extent of economic impact that would occur in Montana if base numeric nutrient standards had to be met today by all publically owned wastewater treatment plants (WWTPs) that would have to comply. DEQ used technical data from engineers and published papers, U.S. census and demographic data, DEQ staff, EPA staff, and data from Montana WWTP operators to carry out the analysis. The analysis shows that affected communities across Montana would bear substantial and widespread economic impacts (i.e., economic hardship) if they had to meet base numeric nutrient standards today. DEQ estimates that greater than 95% of affected Montana communities would bear substantial and widespread economic burden if required to meet the criteria today.

I. Background

The Montana Department of Environmental Quality (DEQ) began developing numeric nutrient standards for state surface waters in 2001. A field pilot study was undertaken from 2001-2003 to identify and refine approaches for developing the criteria in the plains region of the state. Work from 2003-2008 focused on the selection of an appropriate zoning system by which the criteria would be applied, collection of data from reference streams to help with criteria derivation, and identification of harm-to-use thresholds for uses that nutrients affect. During this same period DEQ undertook a focused data collection to support the QUAL2K water-quality model which was then used to develop numeric nutrient criteria for a large river (lower Yellowstone). In addition, DEQ collected data to support lake nutrient standards (this work in ongoing, as are other field projects intended to further refine the flowing water criteria).

In 2008, DEQ released draft nutrient criteria for wadeable streams (Suplee et al. 2008) and presented these to stakeholders. DEQ has subsequently refined the process by which wadeable stream criteria are derived, and is in the process of preparing those as of this writing; draft values are shown below (Table 1) along with draft criteria for the lower Yellowstone River. In Table 1 and throughout this analysis, the N stands for Nitrogen and the P for Phosphorus. While stakeholders understand that the criteria were derived based on sound science and reflect values that are protective of the designated uses, the proposed criteria are stringent (Table 1). As a result, the stakeholder community has been concerned about what their permit limits will be as well as the opportunities for variances. Most WWTPs discharging into wadeable streams do not have instream dilution and will be required to meet the nutrient criteria end-of-pipe. For the Yellowstone River, the proposed criteria are above ambient concentrations during the seasonal low flow period. This situation means that WWTPs discharging directly to the Yellowstone may not need to meet the criteria at the end-of-pipe, although that has yet to be determined.

Table 1. Montana Draft Nutrient Criteria

Level III Ecoregion	Period When Criteria Apply	Parameter		
		Total P (mg/L)	Total N (mg/L)	Benthic Algae Criteria
Northern Rockies	July 1 -Sept. 30	0.025	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Canadian Rockies	July 1 -Sept. 30	0.025	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Middle Rockies	July 1 -Sept. 30	0.030	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Idaho Batholith	July 1 -Sept. 30	0.030	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Northwestern Glaciated Plains*	June 16-Sept. 30	0.12	1.1	n/a
Northwestern Great Plains*, Wyoming Basin*	July 1 -Sept. 30	0.12	1.0	n/a
Yellowstone River (Bighorn R. confluence to Powder R. confluence)	Aug 1 -Oct 31	0.09	0.80	Nutrient concentrations based on limiting pH impacts
Yellowstone River (Powder R. confluence to stateline)	Aug 1 -Oct 31	0.14	1.2	Nutrient concentrations based on limiting nuisance algal growth

Suplee, M., V. Waterson, A. Varghese, and J. Cleland. 2008. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. Montana Department of Environmental Quality.

Due to the difficulty of currently meeting the draft nutrient criteria, Senate Bill 367 was signed by Governor Schweitzer on April 21, 2011. The statute exempts the State and all dischargers from the federal requirement to demonstrate that attaining the designated use is not feasible due to "substantial and widespread economic and social impact" (40 CFR Section 131.10(g)(6)).

SB 367 authorizes individual, general and alternative variances. Under the general variance limits established in SB 367, permit limits would be established at 1 mg/l TP and 10 mg/l TN for facilities discharging $\geq$ 1 MGD or 2 mg/l TP and 15 mg/l TN for facilities discharging $\leq$ 1 MGD. Lagoons would be capped at their current nutrient load.

This paper demonstrates the substantial and widespread economic and social impact of nutrient criteria to the 108 affected public WWTPs in Montana. This document provides DEQ's demonstration supporting the statute language that all dischargers are exempt from meeting the base nutrient standards based on "Substantial and Widespread" economic impacts. Impacts to private dischargers are demonstrated in a separate paper.

II. The Study

Montana's WWTPs

Out of the total number of WWTPs in Montana, which number greater than 200, 108 were selected as WWTPs that would be affected by the nutrient criteria. WWTPs on Indian Reservations were not included due to not being regulated by the state. Also, a large number of WWTPs do not empty into a state water because either they land apply, discharge to groundwater or ___. The 108 WWTPs affect about 50% of Montana's population. The other 50% of Montana citizens are hooked up to one of the other 100 or so WWTPs not affected, or are on a septic system (generally more rurally based). These numbers are for residential hook-ups and do not include small and large businesses, schools or government.

Existing wastewater fees in affected Montana towns average about 0.9% of a town's median household income (MHI) across the state (based on a sample of 48 towns), with larger towns paying as little as 0.43% MHI and smaller towns paying up to 1.68% MHI (Figure 1). However, there is no clear correlation between town size and current wastewater fees, with the exception of large towns over 19,000 in population generally paying less due to a larger population to spread out costs. Different towns pay different rates due to the age and effectiveness of the current system, past grant monies, current level of technology, size and quality of receiving stream, groundwater infiltration, and incoming wastewater quality. Most towns currently pay less than 1.5% MHI, with the majority of those paying less than 1.0% of MHI for wastewater treatment.

Figure 1- Current Annual Wastewater Costs as a Percentage of MHI in Montana Communities

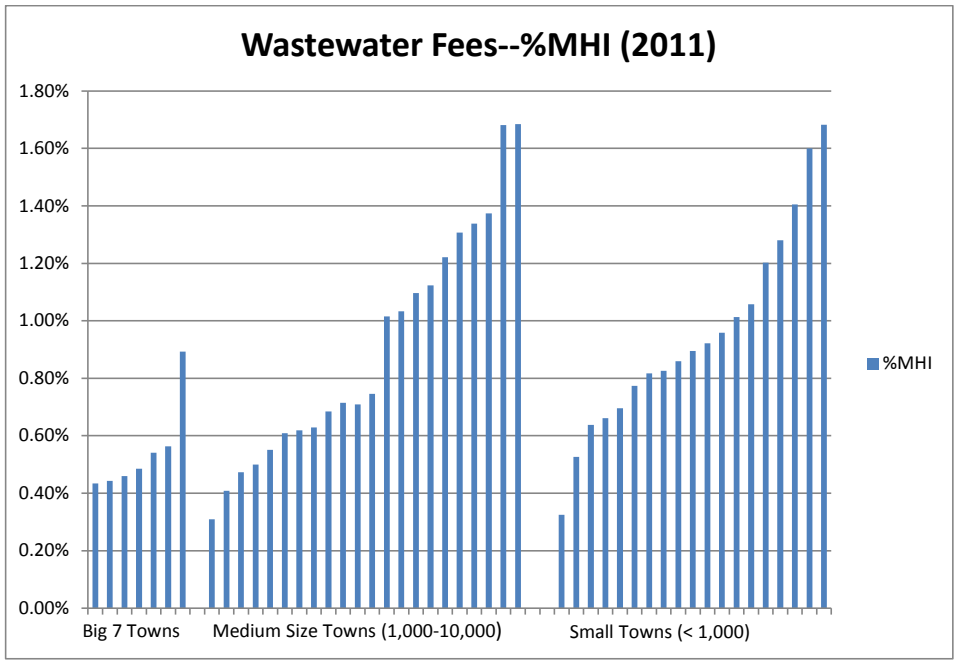


Figure 1. Wastewater rates as a function of median household income as of 2011. Communities were initially selected via a stratified random process for three groups (small, medium, and large communities) . Later on, about 18 other communities were added with a focus on larger and medium towns.

Summary of DEQ's Three-Step Process for Determining Substantial and Widespread Impacts

EPA regulations allow a variance if the pollutant controls "…would result in substantial and widespread economic and social impact" (40 CFR 131.10(g)(6)). For public entities (e.g. WWTPs), EPA's 1995 Guidance (the guidance) suggests a three-step process to determine substantial economic impacts and an additional analysis to determine widespread impacts. DEQ followed the guidance in this demonstration to determine whether WWTPs in Montana would face economic hardship from base nutrient criteria.

Following the guidance, the first of two major "tests" in the Substantial determination (the first step) is to demonstrate that meeting the numeric nutrient criteria today would cost more than 2% of a community's Median Household Income (MHI) for most or all Montana communities with affected WWTPs. For this step, DEQ calculated the "Municipal Preliminary Screener (MPS)" value per the guidance for a subset of dischargers reviewed as part of DEQ's demonstration. The MPS is an estimate of the per household cost of proposed pollution controls plus existing wastewater fees as a percent of median household income (%MHI). If the MPS value for these fees is equal to or greater than 2% MHI for a given town, then the Guidance suggests possible Substantial impacts and the discharger proceeds to the Secondary test, which is the second major "test" in the Substantial determination. The Guidance also allows a town with an MPS value of 1-2% to proceed on to the Secondary test, because the 1-2% range falls into an "uncertain effect" range.

For the Secondary test (step 2), DEQ evaluates a suite of five socioeconomic indicators for each affected town. Montana's Secondary test, as modified from the guidance, looks at the following economic metrics for a given town and compares the town level of each metric to the state average.

- Poverty Rate
- Low and Moderate Income rate
- Unemployment Rate
- Median Household Income
- Current local tax and fee burden

DEQ converted indicator values to a score of 1(weak), 2(mid-range), or 3 (strong) and averaged all 5 indicators to obtain a community indicator value from 1-3. If a given town generally scored weak on the five indicators, this would be an indication that the town would be more significantly impacted by the higher wastewater rates, and thus face a substantial impact. If it scored generally strong on the five indicators, then the town might not be as significantly affected and may not face a substantial impact (in which case it could afford the new fees).

The outcomes of both tests, the Screener and the Secondary test, were assessed on a matrix (step 3) found in the guidance (Figure 2) to determine if water treatment costs to meet standards would cause substantial economic impact. If a town lands within a check mark or question mark within the matrix,

then the this constitutes a 'Significant' finding for that town with the affected WWTP. For example, a community with:

a. A mid-range (1.5-2.5) secondary test score and a high (> 2.0%) municipal preliminary screener score, would have substantial economic impact from meeting the new wastewater standards.

b. A mid-range (1.5-2.5) secondary test score and a low (< 1.0%) municipal preliminary screener score, would not have substantial economic impact from meeting the new standards.

Figure 2. Secondary Score Indicator Matrix

		Municipal Preliminary Screener		
		> 2.0% (weak)	1.0% - 2.0% (mid-range)	< 1.0% (strong)
Secondary test score	< 1.5 (weak)	✓	✓	?
	1.5 – 2.5 (mid-range)	✓	?	✖
	> 2.5 (strong)	?	✖	✖

✓ = Substantial economic impact
? = Possible substantial economic impact
X = No substantial economic impact

The third step in the hardship assessment is to demonstrate a 'Widespread' finding for all or almost all Montana communities with affected WWTPs. The guidance calls for a separate "widespread" demonstration that uses a variety of possible economic indicators, but with much more flexibility than the procedure for substantial impacts. The widespread demonstrations should assess the magnitudes of such indicators as increases in unemployment, losses to the local economy, changes in household income, decreases in tax revenues, indirect effects on other businesses, and increases in sewer fees for remaining private entities. While these widespread indicators are examples of things to look at, none are mandatory, and the analyst has discretion as to which to use. The Widespread analysis is discussed in more detail below.

Analysis Sample

22 publicly owned plants, WWTPs, were evaluated as a representative subset of the larger population of 108 affected Montana dischargers. The public dischargers selected for the analysis represented larger communities with major dischargers (> 1MGD), smaller towns with minor dischargers (< 1 MGD), and lagoon systems. Site specific information on the existing treatment technologies, facility-specific effluent data and community demographics were obtained for this subset and extrapolated to publicly owned plants throughout the state with similar wastewater treatment trains and similar demographics. Appendix A presents two spreadsheets with the calculations and results of the analysis. Appendix B documents all the underlying assumptions applied for this demonstration.

Within Montana, the size and types of public wastewater treatment plants vary significantly, ranging from lagoon systems to systems using advanced biological nutrient removal. Table 2 summarizes the

number of major and minor public dischargers in the State, and the selected sample. It is clear from the table that the major dischargers were completely represented within the 22 towns selected for analysis, while the lagoons were represented by a small subset of the lagoon total. This was done because it is assumed that all small towns with lagoons would experience significant and widespread impact, while some major and minor dischargers may not. Therefore, the subsample included towns most likely to not experience economic hardship, and thus be able to afford to reach base nutrient criteria. This was done to err on the side of being conservative in attaining a hardship finding.

Table 2. Municipal WWTPs in Montana Affected by Nutrient Criteria

	Major Discharger (Big 7 Towns)	Advanced Discharger > 1 MGD	Advanced Discharger < 1 MGD	Lagoons
All Montana Dischargers	7	7	10	84
Percent of total affected WWTPs	6.5%	6.5%	9.3%	77.8%
Subsample	7	5	2	8

To address the first step in the Substantial test, DEQ developed a detailed Excel spreadsheet (Appendix A) to calculate the annualized capital and operations and maintenance costs (O&M) for the 22 towns associated with meeting the base numeric nutrient standards. The spreadsheet also estimated the percent of MHI associated with the increased sewer rates plus current sever rates. Reverse Osmosis was assumed as the technology needed to attain the criteria. Capital and O&M costs for attaining nutrient standards were estimated from the Interim WERF study: "*Finding the Balance Between Wastewater Treatment Nutrient Removal and Sustainability, Considering Capital and Operating Costs, Energy, Air and Water Quality and More*" (Draft 2010). The interim WERF study looked at five different levels of nutrient treatment from no treatment (level 1), to a treatment that is slightly less stringent than the base criteria (level 5). Level 1 treatment in the study is more advance than lagoons, but still does not really treat N and P. Level 2 treatment is about the same as the variance levels outlined in SB 367. Table 3 summarizes the attainable effluent quality and costs of the five different treatment levels from the interim WERF study. Table 4 summarizes the water treatment processes used in the study for each of those five levels.

Table 3. Effluent Quality and Associated Treatment Costs in the Interim WERF study (WERF 2011)

Level	Description	Capital Cost (million dollars per 1 GPD design flow)	Operations Cost (dollars per day per 1 MGD actual flow)
Level 1	No N and P removal	9.3	250
Level 2	1 mg/l TP; 8 mg/l TN	12.7	350
Level 3	0.1-0.3 mg/l TP; 4-8 mg/l TN	14.4	640

Level 4	<0.1 mg/l TP; 3 mg/l TN	15.3	880
Level 5	<0.01 mg/l TP; 1 mg/l TN	21.8	1370

Table 4. Unit Processes per Treatment Level in WERF Study (WERF 2011)

Level	Liquid Treatment	Solids Treatment	Comment
1	Primary Clarifier Activated Sludge Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Conventional Activated Sludge for BOD/TSS removal
2	Primary Clarifier Activated Sludge Alum (optional) Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal
3	Primary Clarifier Activated Sludge Methanol (optional) Alum (filtration) Filtration Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal and Filtration
4	Primary Clarifier Activated Sludge Methanol (optional) Alum/Polymer (Enhanced Settling) Enhanced Settling Filtration Disinfection Dechlorination	Fermentation Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal, High Rate Clarification and Denitrification Filtration
5	Primary Clarifier Activated Sludge Methanol (optional) Alum/Polymer (Enhanced Settling) Enhanced Settling Filtration Microfiltration Reverse Osmosis Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal, High Rate Clarification, Denitrification Filtration, and MF/RO on about Half the Flow

Costs for the S&W demonstration were estimated based on the assumption that reverse osmosis (RO) would be the technology used to meet base nutrient criteria.[1] Current nutrient levels and treatment

[1] A 'Pilot Study for Low Level Phosphorus Removal' ([2010] Hal Schmidt, P.E.MWH Americas, Inc.), conducted in Florida shows that for TP, TN, and other micro-pollutants, RO was indeed the most effective method for removing

cost at the 22 sample towns were compared to nutrient levels and costs that would be needed to meet RO based on the WERF study. In this way, annual capital and operations costs needed for meeting base nutrient criteria were applied to each town, and new wastewater bills were calculated for a scenario where towns would have to meet RO and thus base nutrient criteria today. Towns that have lagoons were assumed to have to pay the listed costs per MGD to get to the criteria. Towns with advanced treatment were assumed to have already paid for some costs. If a town already met WERF level 2, for example, then the level 2 costs for both capital and operations were subtracted from level 5 costs. It is important to note that the operations costs of meeting base numeric criteria taken from the WERF study (Talbe 3) do not include labor and maintenance costs, so the costs estimates may be slightly low (conservative). WERF level 5 is not quite as stringent as the Montana base nutrient criteria, so the costs to reach nutrient standards estimated for this demonstration are potentially underestimated.

III. Results

Substantial Impact

Table 5 presents the Municipal Preliminary Screener results for the 22 communities evaluated in the analysis. DEQ examined the costs that would be incurred the largest seven Montana towns (Billings, Great Falls, Missoula, Bozeman, Butte, Helena, and Kalispell). Missoula was assumed not to have to meet the criteria for the Clark Fork, but was included anyway. The rationale for this approach was that if any WWTPs could afford meeting numeric nutrient criteria, it would be Montana's largest towns due to the already-sophisticated systems in place and/or large populations across which costs can be dispersed (economies of scale). Differences in the MHI levels for these seven towns include current levels of nutrient treatment, town population, current MHI, and current wastewater fees. Based on our analysis, four out of seven of the largest towns in Montana would score over the 2% MHI threshold to meet base criteria (Table 2). The three that would not are highlighted in blue, with the understanding that one of three, Missoula, already meets standards. Of the total 22 towns, our analysis also included larger, advance systems greater than 1 MGD flow, advanced systems (non-lagoon) less than 1 MGD, and lagoons. The breakout of all 22 towns is given below.

Table 5. % MHI Results for towns to reach Base Criteria

Community	Expected % MHI	Population	MGD (Design Flow)
The Big Seven Montana Towns			
Kalispell	**1.83%**	$39,953.00	5.4
Bozeman	2.92%	$41,661.00	13.8
Helena	**1.72%**	$47,152.00	5.4
Butte	2.15%	$37,335.00	8.5

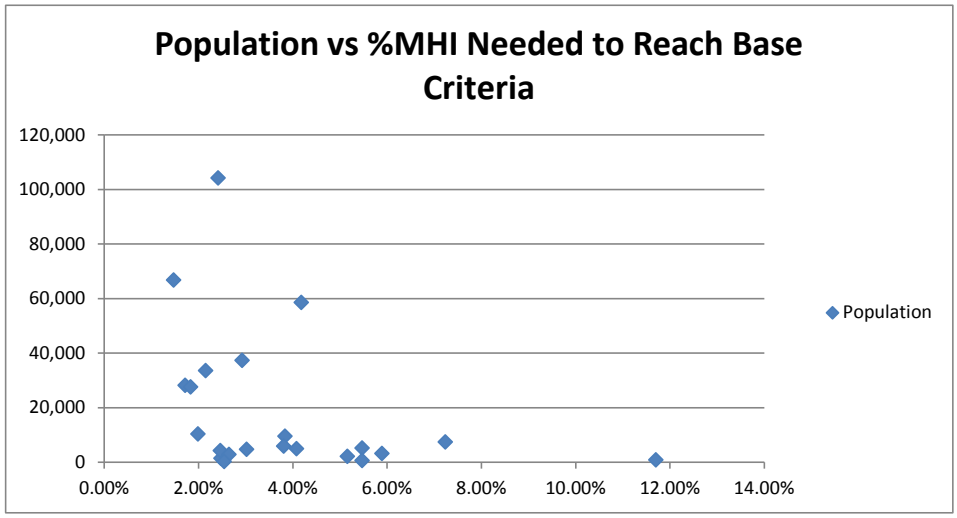
TN and TP (better than membrane bioreactor, MBR). Dave Clark of HDR Engineering, agreed that RO is the treatment that results in the lowest TN levels, and that the WERF report accurately reflects capital and operations costs for RO. Thus, this study supports the assumption of using RO technology for this demonstration of economic hardship. (It is important to note that this does not mean that Montana WWTPs would use RO to meet LOT or nutrient criteria in practice.)

Billings	2.41%	$45,004.00	26
Missoula	**1.47%**	$34,319.00	12
Great Falls	4.18%	$40,718.00	26
Other Large Montana Facilities > 1 MGD			
Livingston	7.23%	$35,689.00	5
Miles City	3.83%	$37,554.00	3.7
Hamilton	5.47%	$25,161.00	1.98
Lewistown	3.81%	$31,729.00	2.5
Havre	1.99%	$43,577.00	4.4
Non Lagoon Facilities < 1 MGD			
Columbia Falls	3.02%	$38,750.00	0.766
Manhattan	2.48%	$50,729.00	0.6
Lagoons			
Philipsburg	11.70%	$31,375.00	0.2
Cut Bank	2.65%	$44,833.00	0.643
Deer Lodge	5.89%	$40,320.00	3.3
Glendive	4.08%	$42,821.00	1.3
Redlodge	5.16%	$50,123.00	1.2
Big Fork	2.77%	$44,398.00	0.5
Highwood	2.54%	$62,614.00	0.026
Circle	5.47%	$29,000.00	0.16

Of the other 15 towns that are smaller than the "big 7", all but one would face a 2% MHI if required to meet the base numeric nutrient criteria (Table 5). Havre came in at 1.99% MHI, just below the threshold. All smaller towns with lagoons scored more than 2% MHI. From the analysis is it clear that small towns in Montana, which comprise the vast majority of affected WWTPs in Montana (78%), would pass the 2% MHI threshold (Municipal Preliminary Screener). Figure 3 shows a plot of the 22 town sample comparing population to %MHI. The one trend that stands out is that the largest towns would

typically pay between 1.4 and 4% MHI to meet the criteria while all other towns in the sample cover a wider range.

Figure 3-Population Versus Percent MHI Needed to Reach Base Nutrient Criteria



To further support SB 367, actual engineering data was available for 4 of the 22 sample towns to assess compliance with the SB 367 general variance requirements of 1 mg/l TP and 10 mg/l TN for several WWTPs. This level of compliance is comparable to Level 2 in the WERF study. DEQ compared these cost estimates to the generalized costs from the national WERF study. These data also indicate that most small communities would face >2% MHI to meet variance levels of nutrient removal in SB 367 that are at least one magnitude less stringent than the base nutrient criteria.

Commented [BJ1]: We may want to delete this paragraph and Table 4—or move them elsewhere.

Table 4. Estimated cost relative to community median household income for Montana communities to remove nutrients to the concentrations specified for each.

WWTP	Data Source	Level of Treatment (approx)	Percent MHI to meet level of treatment
Phillipsburg		15 mg TN/L; 2 TP mg/L	2.57
Deer Lodge		10 TN; 1 TP mg/l	4.05
Manhattan		10 TN; no TP removal	3.38
Columbia Falls		4-8 TN; 0.5-1.0 TP	1.34

Calculation of the Secondary Score

The second step in demonstrating Substantial effects from meeting nutrient criteria involves evaluating a community's current economic health. This is referred to in the guidance as the Secondary Score. DEQ calculated the secondary score values for the 22 communities (listed in Table 5) by obtaining data

from the following sources. Appendix C provides the secondary scores for each community, along with the total secondary score value and the five socioeconomic indicators.

Table 6. Data Sources for the Secondary Score Indicators

Secondary Score Indicator	Data Source	Weblink
Poverty Rate	Montana Census Data (MT CEIC); 2000 Census; 2009 American Community Survey Data	http://ceic.mt.gov/Demographics.asp http://www.census.gov/prod/2010pubs/acsbr09-1.pdf
Low and Moderate Income rate (LMI)	Montana Census Data (MT CEIC); Census 2000	To calculate LMI for each block group, the number of families with 80% of $40,487 is divided by the total number of families in that block group.
Unemployment Rate	Source: Montana Department of Labor and Industry Research and Analysis Bureau	http://www.ourfactsyourfuture.org/ Montana: http://www.ourfactsyourfuture.org/cgi/databrowsing/?PAGEID=4&SUBID=123
Median Household Income	Montana Census Data (MT CEIC), U.S. Census Bureau, Small Area Income and Poverty Estimates	http://www.census.gov/hhes/www/saipe/index.html
Current local tax and fee burden	Annual Financial Reports of the Cities and Towns of Montana, sheet entitled "Government-wide Statement of Activity", Local Government Services Bureau, Dept of Administration, State of Montana, Kim Smith, (406) 841-2905.	DEQ calculated an index based on current local taxes and fees plus local property taxes, indexed by population and MHI. A histogram of all towns in the "tax index sample' (39 towns total) created a weak, medium and strong score for each town compared to the state average

For each community, each of these five economic indicators are scored as either weak, average or strong compared to state averages. Although initially used in the Municipal Screener to determine if the 2% threshold was met, Median household income is applied differently in the context of the Secondary score and provides a general indicator of the health of the community. The stronger the secondary score numerical rank is (the average score of the five economic metrics), the more able a town is expected to pay towards for meeting numeric nutrient criteria. The highest or strongest score a community could get would be a 3.0 (based on scoring a 3 score on all five categories—See Appendix 3) and lowest would be a 1.0 (based on scoring a 1 score on all five socioeconomic categories). An average score of less than 1.5 for the five indicators is considered an overall weak Secondary score, 1.5 to 2.5 is considered mid-range, and over 2.5 is considered strong according to the Guidance.

Results from the Municipal Preliminary Screener (step 1) are combined with the community's secondary score (step 2) to determine if a town is facing significant "Substantial" impacts (step 3) associated with meeting the base nutrient standards (see Figure 2 on page3) .

Secondary score values for the 22 Montana towns sampled ranged between ___ and ___ (Table 6). Larger towns (i.e, Billings, Bozeman, Helena, Great Falls, Missoula) has secondary scores between 2.0 or 2.2. Combined with the MPS results, 2_ out of 22 of the sample communities were considered to be "substantially" affected by requirements to meet the numeric nutrient criteria. For more info on the Secondary scores for the 22 towns, see Appendix 3.

Table 6. Secondary Scores for MT communities (not complete)

Community	Secondary Score
Kalispell	
Bozeman	2.0
Helena	2.4
Butte	
Billings	2.0
Missoula	2.0
Great Falls	2.2
Livingston	
Miles City	
Hamilton	
Lewistown	2.0
Havre	2.2
Columbia Falls	1.8
Manhattan	
Philipsburg	1.6
Cut Bank	
Deer Lodge	
Glendive	
Red Lodge	

Big Fork	
Highwood	
Circle	2.0

As demonstrated above, almost no towns in Montana would score a strong Secondary score and less than 2% MHI (both of which would need to happen for a finding of non-Significant impact). Indeed, only four towns scored less than 2% MHI, and none of those has a strong secondary score. This is likely to be the case for all of Montana, as almost every town will score greater than 2% MHI and thus gain a significant finding per the matrix in the guidance. Even if the four towns that would pay less than 2%, had scored strong in the Secondary score, that would only be 4 towns out of 108 that would not face a Significant impact. But, these four do not score strong on the secondary score. Thus, because step one and step two are met for 100% of Montana towns, a substantial impact has been demonstrated. We have shown this to be the case for virtually every town in Montana.

Widespread Analysis

The third major metric in the S&W demonstration is the widespread test. The guidance does not provide direct ratios or specific tests for a Widespread finding, nor does it provide a straightforward method of proving Widespread impacts (as it does for a Substantial finding). In addition, it suggests looking at some of the economic metrics that are used in the two Substantial tests. From the Guidance:

"The financial impacts of undertaking pollution controls could potentially cause far-reaching and serious socioeconomic impacts. If the financial tests outlined in Chapter 2 and 3 suggest that a discharger (public or private) or group of dischargers will have difficulty paying for pollution controls, then an additional analysis must be performed to demonstrate that there will be widespread adverse impacts on the community or surrounding area. There are no economic ratios per se that evaluate socioeconomic impacts. Instead, the relative magnitudes of indicators such as increases in unemployment, losses to the local economy, changes in household income, decreases in tax revenues, indirect effects on other businesses, and increases in sewer fees for remaining private entities should be taken into account when deciding whether impacts could be considered widespread. Since EPA does not have standardized tests and benchmarks with which to measure these impacts, the following guidance is provided as an example of the types of information that should be considered when reviewing impacts on the surrounding community." (Chapter 4, first paragraph, found at http://water.epa.gov/scitech/swguidance/standards/economics/chaptr4.cfm)

DEQ considered the widespread analysis based on the following basic question: For Montana towns, which would all be Substantially affected by having to meet Base Numeric Criteria, what are the economic and social ripple effects of that substantial impact on the local area? An important step in this question was to define the geographic area where project costs pass through to the local economy. For Montana's widespread analysis, DEQ established the entire state as the "geographic area" considered in the widespread demonstration.

The Widespread argument was made for all towns together rather than individual towns, due to the impracticality of showing widespread impact for each of the 22 towns in the sample, much less all 108 affected towns. Widespread Impacts were evaluated by their cumulative effect and by the DEQ analyst's Best Professional Judgment. Most towns are small and rural or small and a suburb of a larger town. Statewide, there are approximately 95 small towns (under 5,000 in population) out of the affected 108. The other 13 affected towns are "medium to large" and are more urban-based with more diverse economies. Six of these thirteen towns have more than 20,000 in population and a seventh town (Kalispell) is at an estimated 19,927 persons (Montana CEIC, American Community Survey). The other six towns of the "medium to large" 13 are between 5,000 and 10,000 in population (see Table 7).

Table 7—Population Distribution of all 108 Affected Towns

	Large Towns (20,000 and over)	Medium Towns (between 5,000 and 10,000)	Small Towns (under 5,000)
Number	7	6	95
Percentage of Total affect towns	6.5%	5.6%	88.0%
Percentage of Montana households that would be affected by Nutrient Criteria – 50% (approximately)			

DEQ believes that at least 95% of the 108 affected Montana towns (103 out of 108) would experience widespread impacts by having to meet base numeric nutrient standards today. DEQ's Widespread argument is as follows.

- The fact that almost every town in Montana (estimated 104 out of 108) would experience a 2% or greater impact on MHI from having to meet numeric nutrient criteria suggests widespread impacts across the state. Of the 22 communities examined, 18 showed a 2% MHI or greater, and almost certainly the other 86 towns would (smaller and most with lagoons). The aggregated effects of the 2% MHI or greater on such a large number of individual communities would likely result in widespread effects at the statewide scale.
- Most small towns (< 5,000) are agricultural-based with treatment lagoons. The cost of achieving standards relative to MHI will be much higher than 2% for many of these small towns considering that most have lagoons that would need complete, major upgrades and most have small populations over which to spread that cost. Many of these towns are currently losing population and business, especially in the eastern portion of the state. In addition, these small towns already currently have the higher sewer rates within the state (on average) than the largest seven town.
- All affected towns but four in Montana would pay at least 2% MHI in their total wastewater bill to meet base numeric nutrient standards, or significantly more than they are currently paying *on average* (current bills average about 0.9% across Montana). Thus, most wastewater bills would at least double on average for communities to meet the numeric nutrient criteria. In a state with less disposable income than the U.S. average, a decrease in disposable income due to higher bills will produce widespread effects on households and businesses (some businesses more than others). A substantial increase in the wastewater bill could tip the scales for a percentage of residences based on decreased disposable income as a result of the increase in the wastewater bill. Residences below the MHI for a town could be hit especially hard.

- Since most small towns do not have diverse economies, even a small decrease in business and in population can have a large effect on small towns that are struggling. For example, some small Montana towns have less than 10 businesses total. Future businesses and homes could located out of town to avoid high wastewater fees, although that is speculative.
- Montana is currently 41st in the nation in per capita income as of 2009 at $22,881 (Data Set: 2005-2009 American Community Survey 5-Year Estimates, American Community Survey, Montana CEIC). Prices in Montana are about average for the U.S. across all goods. Montanans on average do not have as much disposable income as the average American, and may have slightly higher living expenses due to long travel distances and higher heating bills.
- It is assumed that all towns under 5,000 persons would experience Widespread impacts.
- Towns with populations over 5,000 will likely show mixed results in terms of Widespread impact. The six large towns affected by nutrient criteria would experience Widespread impacts in terms of disposable income, but probably not overall (would not see their economy significantly affected). In other words, these large towns would not shut down, but certain residences and businesses would experience substantial impacts. Another 12 or so medium to large towns would probably experience Widespread impacts overall for the same reasons as discussed above, but less severe impacts than the 95 smaller towns with affected WWTPs.
- The current Recession could complicate these effects. Even if one-third of these medium to large towns did not experience Widespread impacts (4 total), more than 95% of Montana's affected towns still would meet the 'almost all' threshold for Widespread impacts.
- To meet the base numeric nutrient criteria will also require hiring highly qualified wastewater engineers. There could be widespread impacts associated with finding these qualified staff for facilities across the state and then paying them a competitive salary. Salaries in Montana for WWTP engineers are (X) but such engineers are hard to find. Operators might be even harder to find.
- The 2010 census data showed that Montana's population is aging. This trend, coupled with increased living expenses associated with meeting the base nutrient standards, could have negative impacts on a statewide scale.
- MDEQ's substantial and widespread analysis assumed that reverse osmosis or some ion exchange treatment technology would be required. Either technology is both economically and environmentally costly. Reverse osmosis generates brine that must be disposed of properly and results in significantly higher greenhouse gas emissions. Aggregated at the statewide scale, both the economic and environmental implications would have widespread impacts for the State of Montana.
- Benefits from meeting base numeric standards would likely not be widespread in terms of economics. Jobs created would be greatest in the short term for construction, and long-term jobs would tend to be small in relation to an area's entire work force, except for the smallest of towns. While environmental benefits would be widespread, economically they may not translate into additional dollars (for tourism, etc.).

Commented [A2]: How many Montana residents rely on WWTps for disposal of sewage?

Commented [EC3]: Same comment as above

Commented [EC4]: See comment above

Conclusions

This demonstration shows that meeting the numeric nutrient criteria on a statewide basis would result in Substantial and Widespread economic impacts to Montanans (for public sector). Of the 22 publicly-owned dischargers reviewed in this analysis, __% of them demonstrated Substantial and Widespread Economic impacts. While 100% of the communities do not face economic hardship, DEQ believes that if __% of the communities demonstrate Substantial and Widespread impacts, then DEQ has shown economic hardship at the statewide scale.

Appendix 1-Spreadsheet of costs and MHI

APPENDIX 2

Description of the Assumptions/ Details in the Spreadsheet

- The sample in this analysis focused on the 7 largest communities in MT, 7 medium sized communities with advanced wastewater treatment, and 8 smaller communities with lagoons .
- Reverse osmosis is assumed to be the technology that would allow WWTPs to meet base numeric criteria.
- The spreadsheet numbers are intended to provide ROUGH ESTIMATES for discussion purposes and do not reflect the site-specific conditions at each plant.
- It is conservatively assumed that the design flows of new RO plants would be the same as current plants, unless otherwise noted. If new RO plants were assumed to be built to accommodate a larger flow, then adverse impacts would be greater.
- Current sewer rates per household were obtained from direct calls to the municipalities to obtain sewer rate information. Paul LaVigne at DEQ was instrumental in collecting many of these numbers.
- The cost estimates for upgrading WWTPs are obtained from the Interim WERF study: "Finding the Balance Between Wastewater Treatment Nutrient Removal and Sustainability, Considering Capital and Operating Costs, Energy, Air and Water Quality and More" (Draft 2010). This report is Draft and the capital costs are anticipated to increase in the final report based on feedback from the technical reviewers. Based on actual costs observed in Region 1, Region 1 considered the capital costs to be higher than experienced in the final facility plan.
- Level 1 in the Interim WERFStudy reflected secondary treatment, which is more advanced treatment than a lagoon system because it assumes a mechanical plant. For lagoons, the total cost of getting to WERF Level 5 was used and was calculated on a pro-rated basis (per flow), minus the current O&M costs for a lagoon. Current O&M costs for a facultative lagoon are assumed to be $50,000 annually for all FLs and $150,000 for an Aerated Lagoon.
- WERF level 5 is not quite as stringent as the Montana base nutrient criteria, so the costs to reach nutrient standards are potentially underestimated.
- For towns with advanced treatment, the cost associated with the WERF level they are at is subtracted form WERF level 5.
- Operation costs include energy and chemical costs only and do not include labor and maintenance cost. As such, these numbers are on the low side. That said, the capital and O&M costs are based on building from scratch, assuming that no infrastructure exists. Towns in Montana already have some infrastructure, so these costs may be an overestimation. Thus, these assumptions may balance out each other.
- Design flow was used to determine the capital costs and actual flow for the Operations costs. Flows for towns were taken from wastewater permits.
- Annual costs of both capital and operations estimates were used in the spreadsheet to calculate the increase in sewer rates and percent MHI.
- Capital costs were assumed to cover a 20-year bond with 5% interest (used a conversion factor of 0.0802).

Appendix 3-Secondary Indicators (need to complete/update)

Table 2-1 Secondary Indicators for the Municipality (or study area) as of 2009. The scores given below are simply an illustrative example.

Town X: Poverty rate 20%, LMI 47%, Unemployment rate 7.1%, MHI $39,201, Property Tax index number 3.0%.

	Secondary Indicators			
Indicator	Weak*	Mid-Range**	Strong***	**Score**
Poverty Rate	More than 22%	10-22%	Less than 10%	**2**
Low to Medium Income Percentage (LMI)	More than 62%	33-62%	Less than 33%	**2**
Unemployment	More than 1% above State Average (>7.2%)	State Average 2009----6.2%	More than 1% below State Average (<5.2%)	**2**
Median Household Income	More than 10% below State Median	State Median--$43,948 (2008)	More than 10% above State Median	**1**
Property Tax, fees and revenues divided by MHI and indexed by population	More than 3.5	3.5 to 2	Less than 2	**3**

* **Weak is a score of 1 point**

** **Mid-Range is a score of 2 points**

*** **Strong is a score of 3 points**

SUM: 10

AVERAGE: 2.00

There are five socioeconomic criteria that are summed up and averaged to see where the households within a community fall in terms of financial health. For each of the five criteria, a strong score is recorded in the right hand column as a '3', indicating strong socioeconomic health for that criteria and thus a greater chance of being able to pay for additional wastewater treatment (and lesser chance of a variance). A mid-range score is recorded as a '2' and indicates moderate or average socioeconomic health for the particular criteria. A weak score should be recorded as a '1' and indicates poor socioeconomic health for the given criteria or less ability to pay (and a greater chance of being granted a variance). The average score of all five indicators falls into those same categories and should be judged in the same way.

For poverty rate and LMI, the strong, mid-range and weak score are derived by taking averages of each of these five indicators for all towns in Montana and then running a histogram. The histogram gives us breaks for strong, mid-range, and weak scores using best professional judgement. The same method is used for Property tax, fees, etc. except that a sample of 30 towns was used to create the histogram, due to the large data requirements and that we had to calculate this figure ourselves.

The last criteria, Property tax, fees and revenues divided by MHI and population, gives an indication of the existing burden on local residents within the municipality of fees for local services and of local taxes. Those citizens of towns already paying a lot of money relatively for services such as wastewater and garbage and/or paying higher local taxes are assumed to be less able to pay additional monies for additional wastewater treatment. Source: Annual Financial reports of the cities and towns of Montana, FY 2007 (Fy ending June 30, 2007) except for Froid which is FY 2008, Worksheet of interest within reports: 'Government-wide Statement of Activity', Local government Services Bureau, Mont.

Assumptions include:

- Population estimates come from Montana CEIC and are based upon Census 2010. Median household income and number of households per community also come from the Montana CEIC and are based on the American Community Survey 5-Year Estimate (2005-2009) .
- Local area taxes, revenues and property taxes are from Fiscal year ending June 30, 2010. This information is from the Local government Services Bureau, Montana Department of Administration, Kim Smith, (406) 841-2905, kims@mt.gov. There is not tax data Big Fork because it is not incorporated, so is required to report this data. Broadus and Columbia Falls - FY2010 unaudited financial statements - audit report delinquent, but the numbers were used anyway.
- Unemployment rates are from July of 2011. Aaron McNay, Economist, Montana Department of Labor and Industry, 406-444-3245. They only have unemployment estimates for cities that have a population that is 25,000 or larger. For the other cities, we can only provide county level estimates. Only Billings, Bozeman, Helena, Missoula and Great Falls have actual estimates for the city.

Secondary Score Case Studies--Public WWTPs

	Poverty Rate (2000)	LMI (2008)	Unemployment Rate (2009)	MHI (estimated 2009 number)	Total Revenues, Fees and Taxes divided by MHI indexed by population (FY 2007)
Billings	12	40.9	4.5	45,004	2.11
Bozeman	20.2	46.4	6.3	41,661	2.69
Circle	18.3	41.1	**3.0**	29,000	2.44

Columbia Falls	17.1	42.5	**10.7**	38,750	2.04
Great Falls	14.5	39.7	4.9	40,718	2.21
Havre	17.5	40.7	5.0	43,577	1.69
Helena	14.5	40.1	4.7	47,152	2.28
Lewistown	13.6	40.1	**4.9**	31,729	2.22
Missoula	19.7	46.8	5.7	34,319	1.41
Phillipsburg	19.8	49.2	**9.2**	31,375	2.86

	Poverty Rate Secondary Score (2000)	LMI Secondary Score (2008)	Unemplyment Rate Secondary Score (2009)	MHI (estimated 2009 number) Secondary Score	Total Revenues, Fees and Taxes divided by MHI indexed by population Secondary Score (FY 2007)	Average Score
Billings	2	2	2	2	2	2.0
Bozeman	2	2	2	2	2	2
Circle	2	2	3	1	2	2
Columbia Falls	2	2	1	2	2	1.8
Great Falls	2	2	3	2	2	2.2
Havre	2	2	3	1	3	2.2
Helena	2	2	3	3	2	2.4
Lewistown	2	2	3	1	2	2
Missoula	2	2	2	1	3	2
Phillipsburg	2	2	1	1	2	1.6